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TRANSLATION

AUTOMATIC STATIONS FLY TO THE PLANETS

By

Yuriy Marinin

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

WRIGHT-PATTERSON AIR FORCE BASE

OHIO

402442

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By: Yuriy Marinin

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PREPARED BY:

TRANSLATION SERVICES BRANCH
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

AUTOMATIC STATIONS FLY TO THE PLANETS

Specialist's Commentary

Yuriy Marinin

APN Scientific Commentator

The scientific world is in waiting. Two events of truly "cosmic" significance are to take place on December 14, 1962 and in June, 1963.

On December 14 the American automatic station Mariner II will bypass Venus, and in June the Soviet automatic station Mars I will bypass Mars.

What are these stations supposed to give to science? The Mariner II is intended for an investigation of Venus' magnetic field, a determination of her atmospheric composition, and a measurement of the temperature of the surface of the planet. For this purpose microwave and infrared radiometers, magnetometers, and other instruments are installed on the station.

The main task for Mars I is to photograph the planet Mars. Why aren't the Americans attempting to photograph Venus? The dense cloud layer surrounding the planet will not permit as valuable scientific data to be obtained as in photographing Mars. But this is not the

main reason. The photographic apparatus and the equipment for transmitting the images would prove too heavy for Mariner II. The weight of the scientific equipment on this automatic station amounts to only 18 kilograms with an overall weight for the station of 200 kilograms. Why cannot the weight of scientific equipment be increased? Because in so doing the weight of the entire station would also be increased, and at present the Americans have no launch vehicles capable of a payload of more than 200 kilograms to Venus. Still another question arises. Why are only 18 of the 200 kilograms allotted to scientific equipment? After all, the scientific equipment is what the whole station was built for, but it remains less than 10 percent of the total weight! What else is the station "filled" with? The electronic equipment weighs about 70 kilograms; the body, 35 kilograms; the control rocket and its fuel supply, 17 kilograms; solar batteries, 22 kilograms; and the chemical battery, 15 kilograms. It is impossible to get by without the body, electronic equipment, and solar batteries; this is clear. But why are the control rocket and chemical battery needed?

To obtain all the planned scientific data, the automatic station must pass at a definite distance from the planet. For example, to obtain photographs of the prescribed clarity and image detail, the Soviet automatic station must pass at a distance of not more than 11 thousand kilometers from Mars. To acquire all the planned data with the aid of the radiometers on the Mariner II, this station must pass at a distance of not more than 40 thousand kilometers from Venus. Thus in flying to a distance of several hundred million kilometers, the "miss" must be no more than several thousand kilometers. For this the automatic station must be ejected into the scheduled trajectory very accurately. To observe this accuracy with the aid of the launch

vehicle alone is practically impossible from the standpoint of present-day engineering. Therefore the space station must be corrected after it separates from the launch vehicle. This is the purpose served by the control rocket. The control rocket system on the Mars I can correct an error of up to 500 thousand kilometers; the control rocket on the Mariner II, an error of up to 800 thousand kilometers. As is known, the launch vehicle errors in lofting both Mars I and Mariner II did not exceed the critical value. For Mars I the deviation was 261 thousand kilometers, and for Mariner II, 375 thousand kilometers. But first let us remember that when the American automatic station Ranger III was launched to the moon, the deviation exceeded the critical value, and, though the control rocket was actuated, the deviation could not be corrected, and the station bypassed the Moon. It should be stressed that a flight to the Moon does not require as accurate an ejection as a flight to the planets. The control rocket of the Mariner II has already been actuated. It was to have reduced the deviation from 375 thousand kilometers to 16 thousand kilometers.

American scientists do not want the cosmic station to pass very close to Venus, since then it might be slowed down in the dense atmosphere of the planet and burn up or hit the planet. The apparatus is not supposed to hit because it has not been sterilized. Thus the intention was to reduce the deviation to 16 thousand kilometers, but the control rocket deviated somewhat from the program, and the "miss" was reduced only to 34 thousand kilometers. This deviation does not interfere with the operation of the radiometers on Mariner II, however (the critical distance for these instruments is 40 thousand kilometers).

Now about the chemical battery. Why a chemical battery for the station, if its instruments and equipment are supplied by solar

batteries? In order for the solar batteries to develop electrical energy, they must be pointed toward the Sun. But where does the energy to keep the solar batteries turned toward the Sun come from? This energy is supplied by the chemical battery. The chemical battery also provides energy while the control rocket is in operation, as the solar batteries do not point toward the Sun at this time. In addition the chemical battery assists the solar batteries when the latter are weakened for some reason or "lose the Sun". And finally, most important, the chemical battery, working simultaneously with the solar batteries, is supposed to provide additional power during the most crucial period as the station bypasses the planet. The energy of the chemical battery, in contrast to that of the solar, is very limited (the energy of the Mariner II battery is only 1000 watt-hours), and therefore this energy must be dearly guarded until the most crucial moment. Sometimes it becomes necessary to make sacrifices in order to conserve this energy. Thus, at the end of October, 1962 for an unknown reason the power of the solar batteries on the cosmic station Mariner II suddenly dropped. The instruments automatically switched over to the chemical battery and began to expend its precious energy. Then the decision was made to shut off the instruments. Let some scientific data on interplanetary space be lost, but as a result of this sacrifice the energy of the chemical battery will be saved until the rendezvous with Venus. Within a short time the power of the solar batteries on Mariner II rose to the prescribed level and the instruments were cut back in on November 9. The automatic stations Mars I and Mariner II are moving close to their scheduled orbits. The apparatus on them is operating normally. The problem of maintaining communication with these space stations becomes the chief concern. After

all, it was just such a communications cutoff which interfered with the conduct of the investigations planned with the aid of the American space stations Ranger IV and Ranger V, and also the Soviet space station launched toward Venus in February, 1961. From the standpoint of communication things will be much more difficult for Mars I than for Mariner II. First, the flight to Mars is longer, and the distance weakens the signals. Second, it takes longer to fly to Mars, and, when the flight is of longer duration, the probability that something will go wrong is also greater. Third, the transmission of photographic images imposes additional requirements on the communication system. But Mars I has also an advantage. Having a considerably more powerful launch vehicle at their disposal, Soviet designers did not have to put 200 kilograms "into the Procrustean bed", as did the American designers. The weight of the Soviet space station is almost four and one-half times greater. And if the weight limitations are less stringent, then it is possible to install on the station more powerful energy sources, more powerful transmitters (the power of the transmitter on Mariner II is only 3 watts), or even reserve energy sources and transmitters. The more powerful the transmitter, the more easily its "voice" carries to earth through the millions of kilometers of cosmic space. And the reserve energy sources and transmitters ensure sustained communication, even if the main ones go out of commission.

The scientists keep listening to the voice of the cosmic messengers.

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